73rd MORSS CD Cover Page

712CD

For office use only 41205

UNCLASSIFIED DISCLOSURE FORM CD Presentation

21-23 June 2005, at US Military Academy, West Point, NY

Please complete this form 712CD as your cover page to your electronic briefing submission to the MORSS CD. Do not fax to the MORS office.

Author Request (To be completed by applicant) - The following author(s) request authority to disclose the following presentation in the MORSS Final Report, for inclusion on the MORSS CD and/or posting on the MORS web site.

Name of Principal Author and all other author(s): **Edward F. Weitzner**

Principal Author's Organization and address:

The Johns Hopkins University
Applied Physics Laboratory
11100 Johns Hopkins Road
Laurel, MD 20723-6099

Phone: **(703) 601-1489**

Fax: **(703) 601-1320**

Email: **edward.weitzner@navy.mil**

Original title on 712 A/B: **The Integrated Natural Environment Authoritative Representation Process**

Revised title:_____

Presented in (input and Bold one): (**WG10**, CG___, Special Session ___, Poster, Demo, or Tutorial):

This presentation is believed to be:
UNCLASSIFIED AND APPROVED FOR PUBLIC RELEASE

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
23 JUN 2005	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The Integrated Natural Environment Authoritative Representation Process	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **The Johns Hopkins University Applied Physics Laboratory 11100 Johns Hopkins Road Laurel, MD 20723-6099**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM201946, Military Operations Research Society Symposium (73rd) Held in West Point, NY on 21-23 June 2005., The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**26**	

THE INTEGRATED NATURAL ENVIRONMENT AUTHORITATIVE REPRESENTATION PROCESS

A brief on some of the relevant aspects of providing an authoritative natural environment to models and simulations.

Presented by Ed Weitzner
The Johns Hopkins University Applied Physics Laboratory
On-Site Support to the Oceanographer of the Navy
73rd MORS Symposium
USMA West Point, NY
21-23 June 2005

The Integrated Natural Environment Authoritative Representation Process (INEARP)

The INEARP is a process developed by the environmental Modeling & Simulation Executive Agents (MSEAs) in collaboration with the Defense Modeling & Simulation Office (DMSO) to meet the environmental representation requirements of the DoD M&S community.

Outline

Background

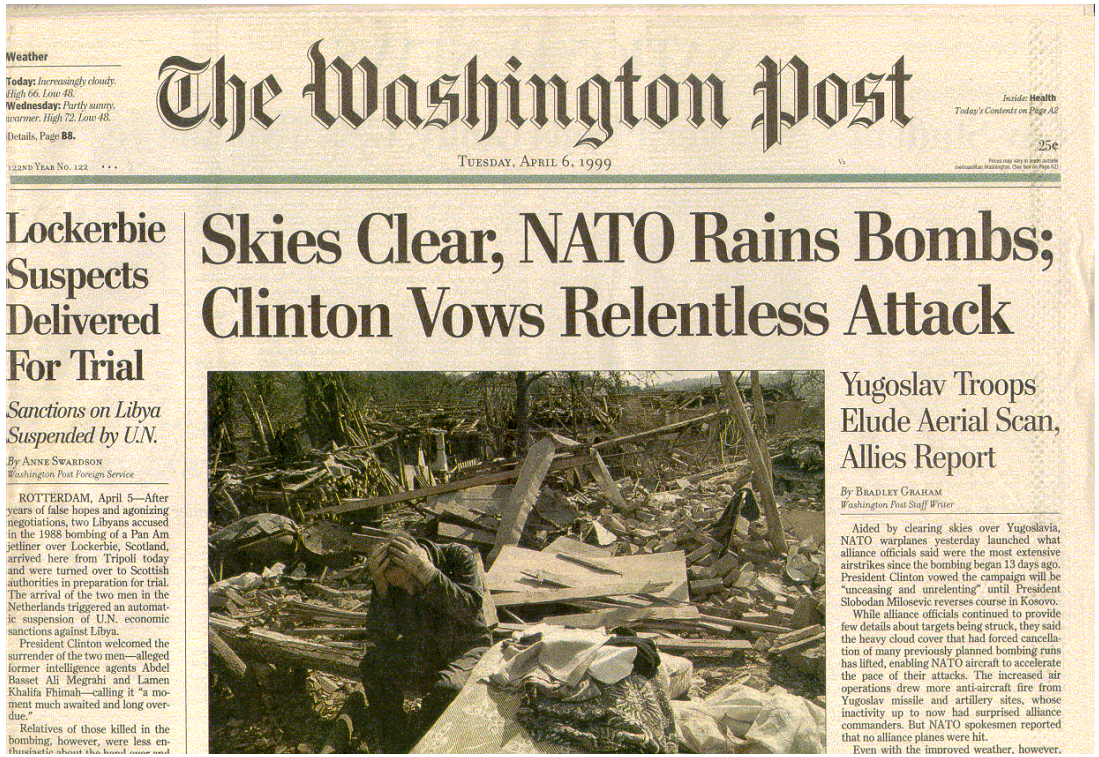
Description

Four Diverse Examples

- Global Naval War Game
- Much-faster-than-real-time Campaign Simulation
- Fleet Battle Experiment
- Theater-wide Naval Campaign Analysis Study

Background

No realistic simulation can be conducted without an in-depth understanding of the environment and its effects on platforms, weapon systems, sensors and people.



Weather

Today: *Increasingly cloudy. High 66. Low 48.*
Wednesday: *Partly sunny, warmer. High 72. Low 48.*
Details, Page B8.

The Washington Post

Tuesday, April 6, 1999

Inside: Health
Today's Contents on Page A2

25¢

122ND YEAR No. 122

Lockerbie Suspects Delivered For Trial

Sanctions on Libya Suspended by U.N.

By Anne Swardson
Washington Post Foreign Service

ROTTERDAM, April 5—After years of false hopes and agonizing negotiations, two Libyans accused in the 1988 bombing of a Pan Am jetliner over Lockerbie, Scotland, arrived here from Tripoli today and were turned over to Scottish authorities in preparation for trial. The arrival of the two men in the Netherlands triggered an automatic suspension of U.N. economic sanctions against Libya.

President Clinton welcomed the surrender of the two men—alleged former intelligence agents Abdel Basset Ali Megrahi and Lamen Khalifa Fhimah—calling it "a moment much awaited and long overdue."

Relatives of those killed in the bombing, however, were less en-

Skies Clear, NATO Rains Bombs; Clinton Vows Relentless Attack

Yugoslav Troops Elude Aerial Scan, Allies Report

By Bradley Graham
Washington Post Staff Writer

Aided by clearing skies over Yugoslavia, NATO warplanes yesterday launched what alliance officials said were the most extensive airstrikes since the bombing began 13 days ago. President Clinton vowed the campaign will be "unceasing and unrelenting" until President Slobodan Milosevic reverses course in Kosovo.

While alliance officials continued to provide few details about targets being struck, they said the heavy cloud cover that had forced cancellation of many previously planned bombing runs has lifted, enabling NATO aircraft to accelerate the pace of their attacks. The increased air operations drew more anti-aircraft fire from Yugoslav missile and artillery sites, whose inactivity up to now had surprised alliance commanders. But NATO spokesmen reported that no alliance planes were hit.

Even with the improved weather, however,

Lessons of Kosovo and the Limits of Air Power

In the first month of the air campaign, <u>nearly half</u> of NATO air combat missions were canceled due to *bad weather*.

DoD Modeling & Simulation Executive Agent Designations

Circa 1995-1996

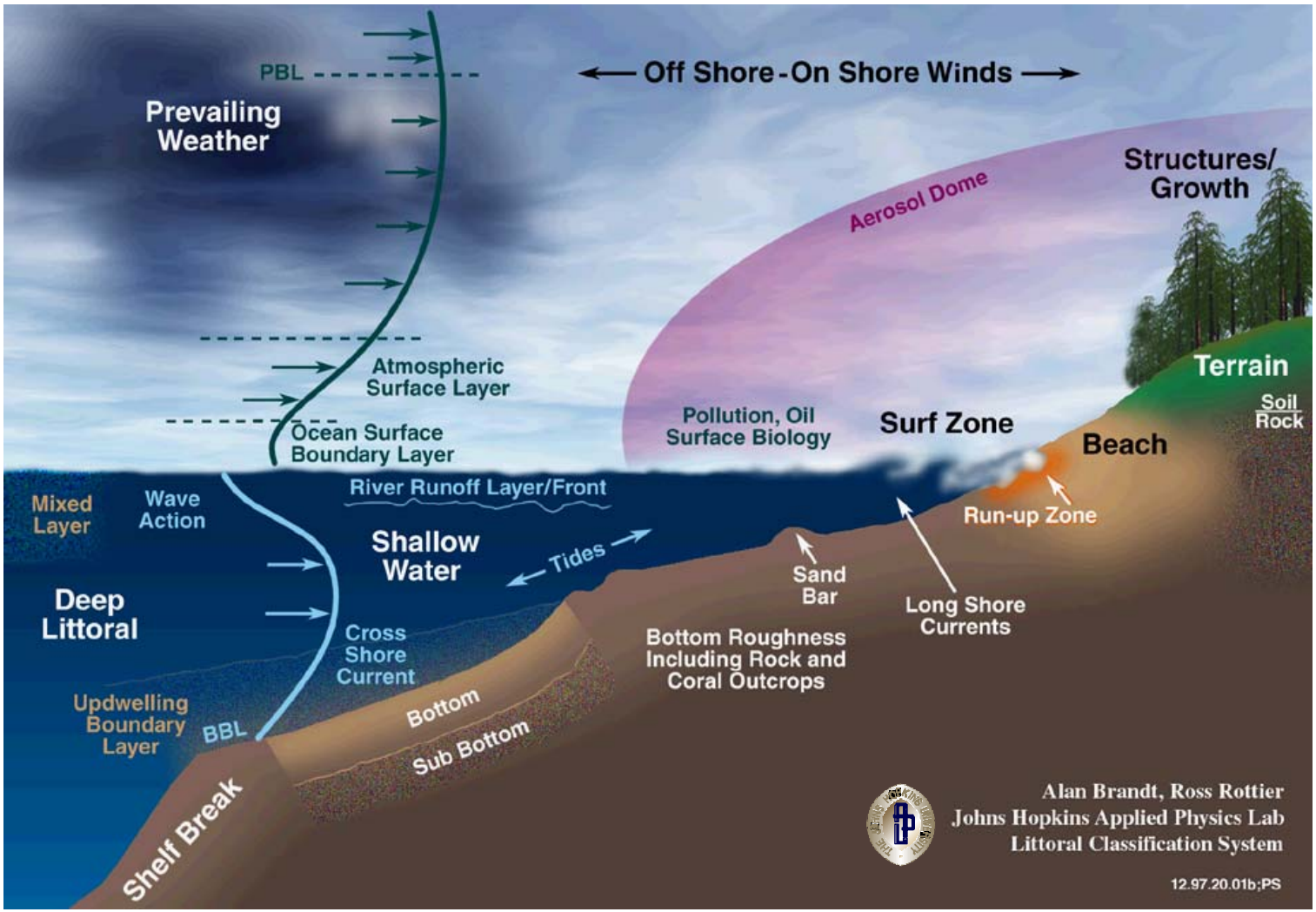
DoD Directive 5000.59, "DoD Modeling and Simulation (M&S) Management," January 4, 1994, stated need for Modeling & Simulation Executive Agents (MSEAs).

Under Secretary of Defense for Acquisition, Technology & Logistics (USD (AT&L)) designated 3 environmental MSEAs:

- **Defense Mapping Agency (now National Geospatial-Intelligence Agency) as MSEA Terrain**
- **Dept of Navy as MSEA Ocean**
- **Dept of Air Force as MSEA Air & Space**

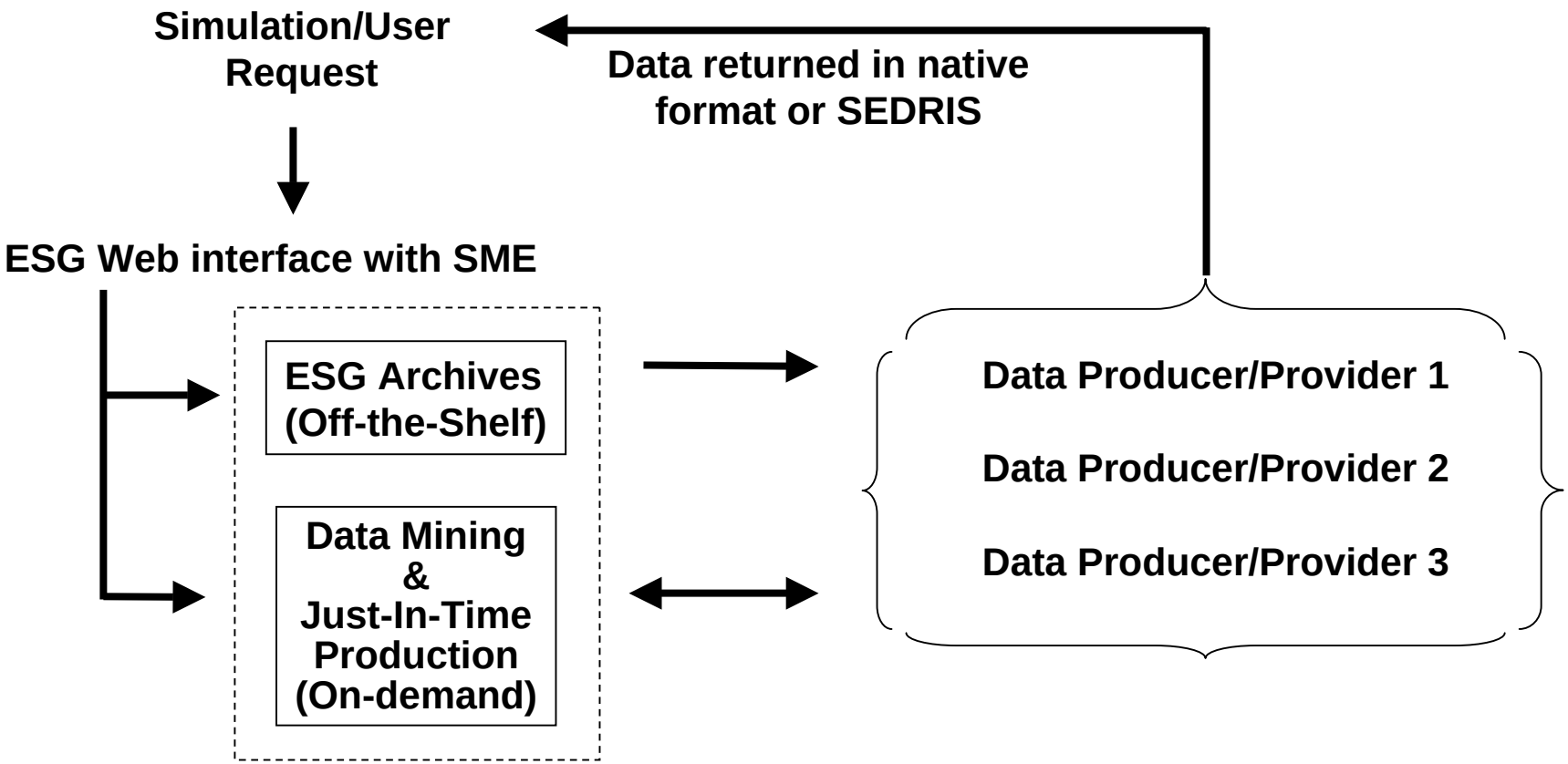
The Environmental MSEA Domain Responsibilities

Terrain – All land and into the ocean to 10 feet water depth at low low tide.
Air & Space – From the surface of the Earth to the Sun.
Ocean – From the ocean sub-bottom to the ocean surface.



Integrated Natural Environment Authoritative Representation Process (INEARP)

Circa 1997- ➡



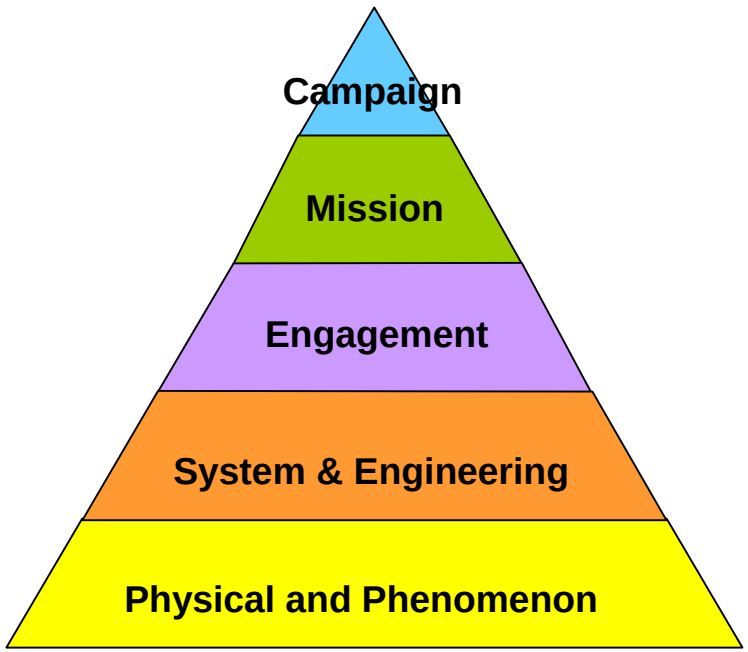
ESG = Environmental Scenario Generator

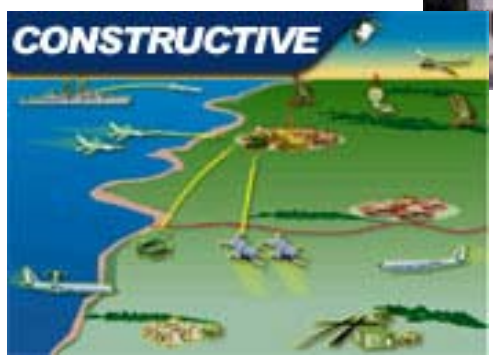
SEDRIS = Synthetic Environmental Data Representation & Interchange Specification

SME = Subject Matter Expertise

The Goal

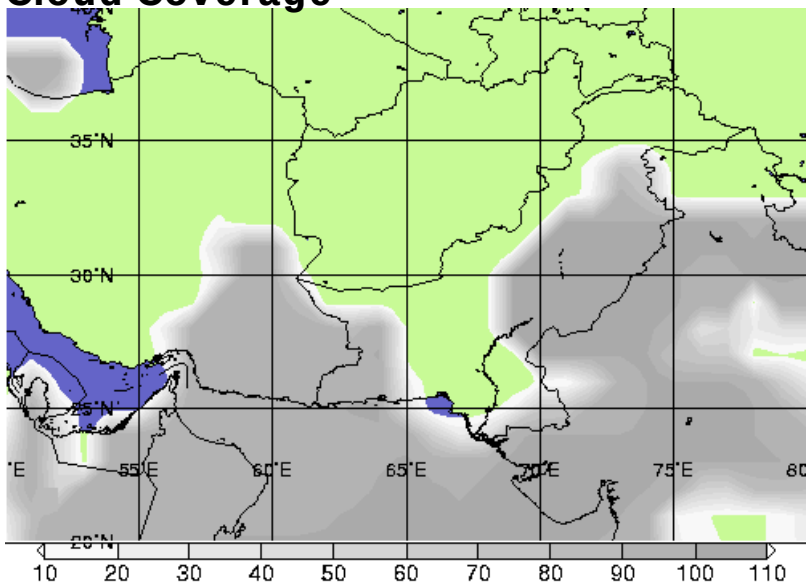
<u>One</u> environmental support architecture for all DoD models and simulations



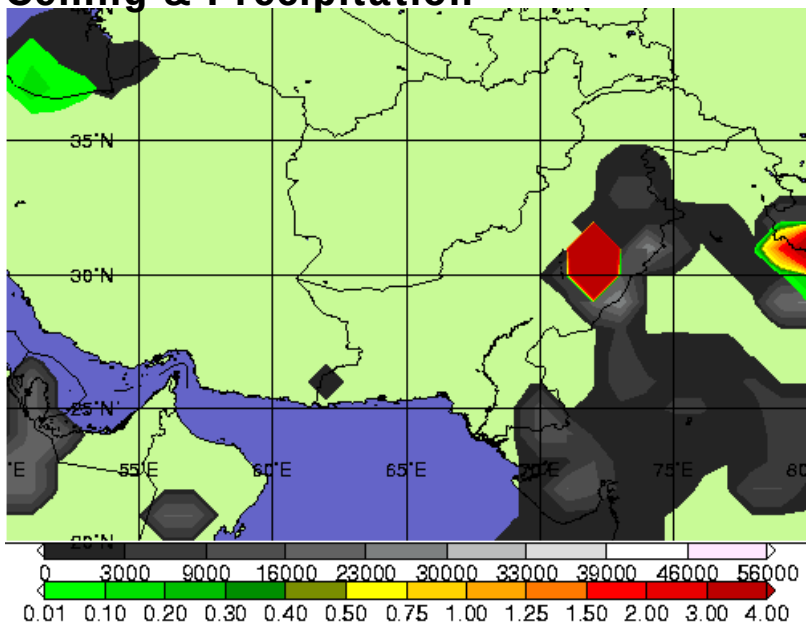


Sample Products from the ESG

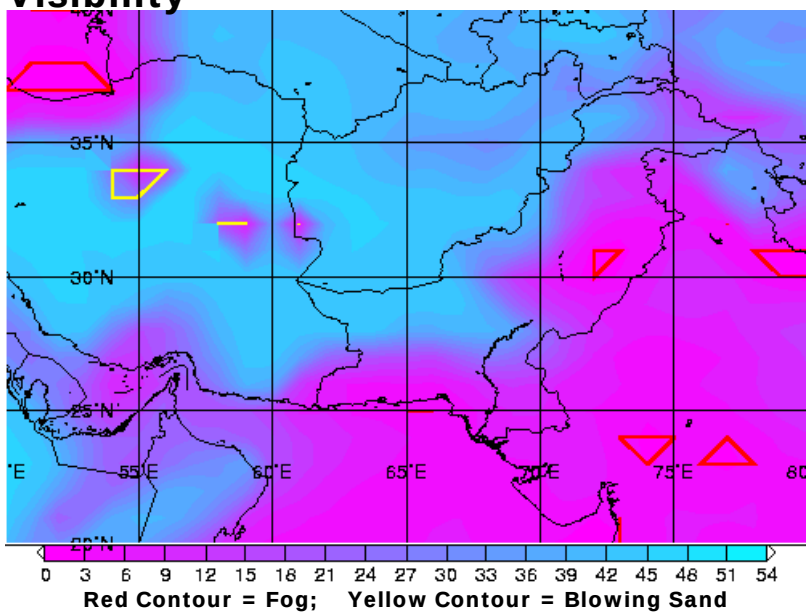
Cloud Coverage



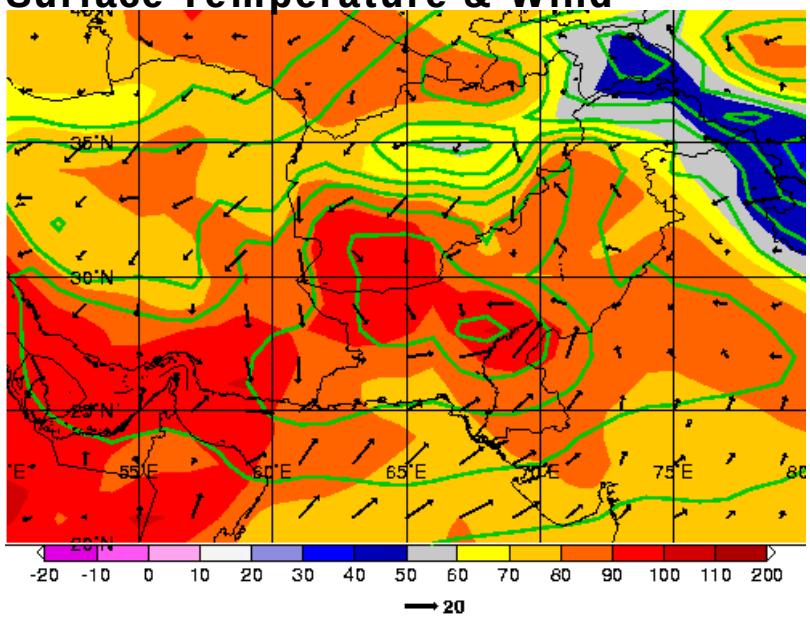
Ceiling & Precipitation



Visibility



Surface Temperature & Wind



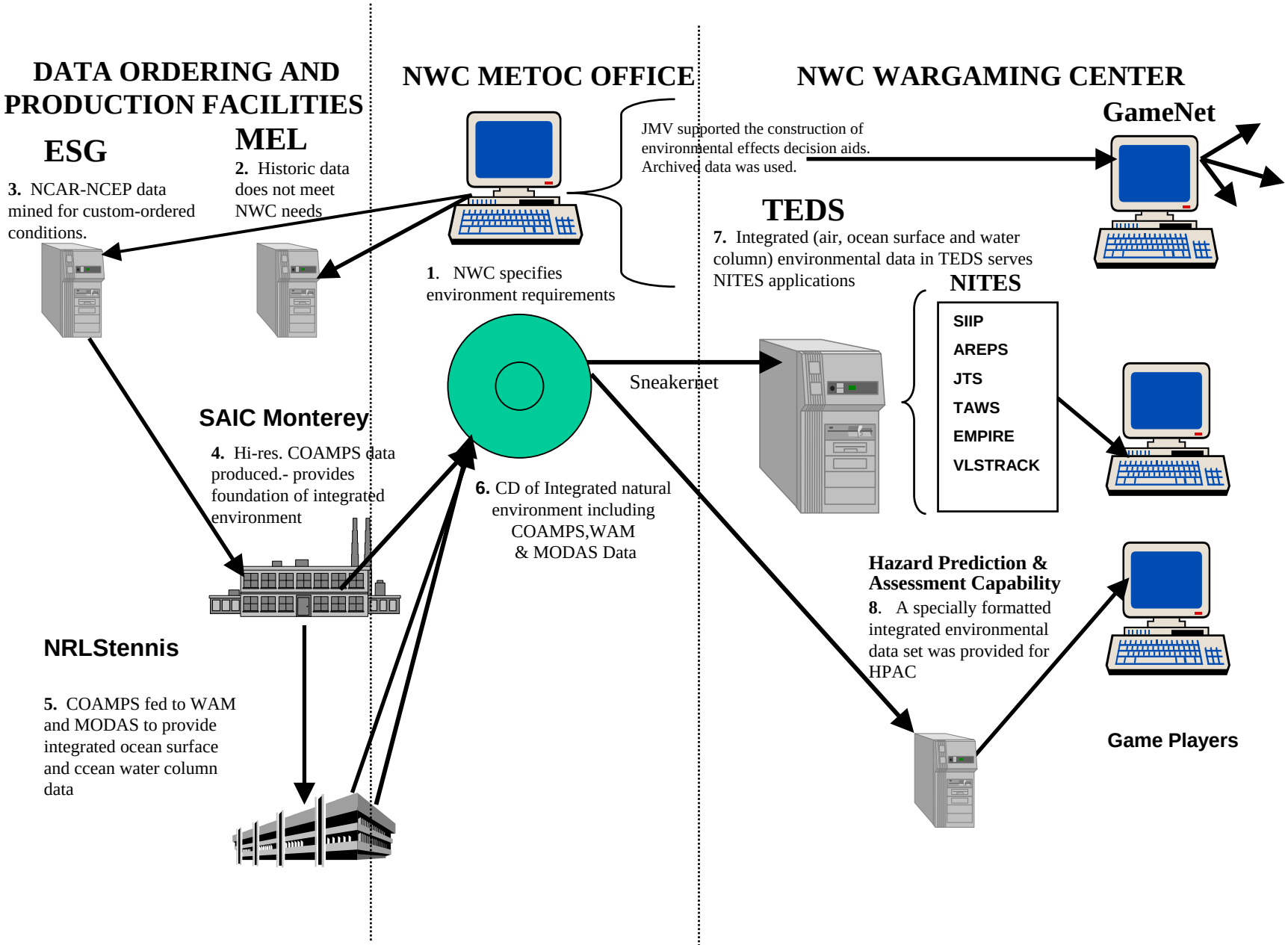
Global War Games

Circa 2000-2001

Naval War College, Newport RI

Issues: (1) Scripted Environmental Scenarios
(2) Game Floor Computer Decision Aids

GLOBAL 2000 METOC Information Flow



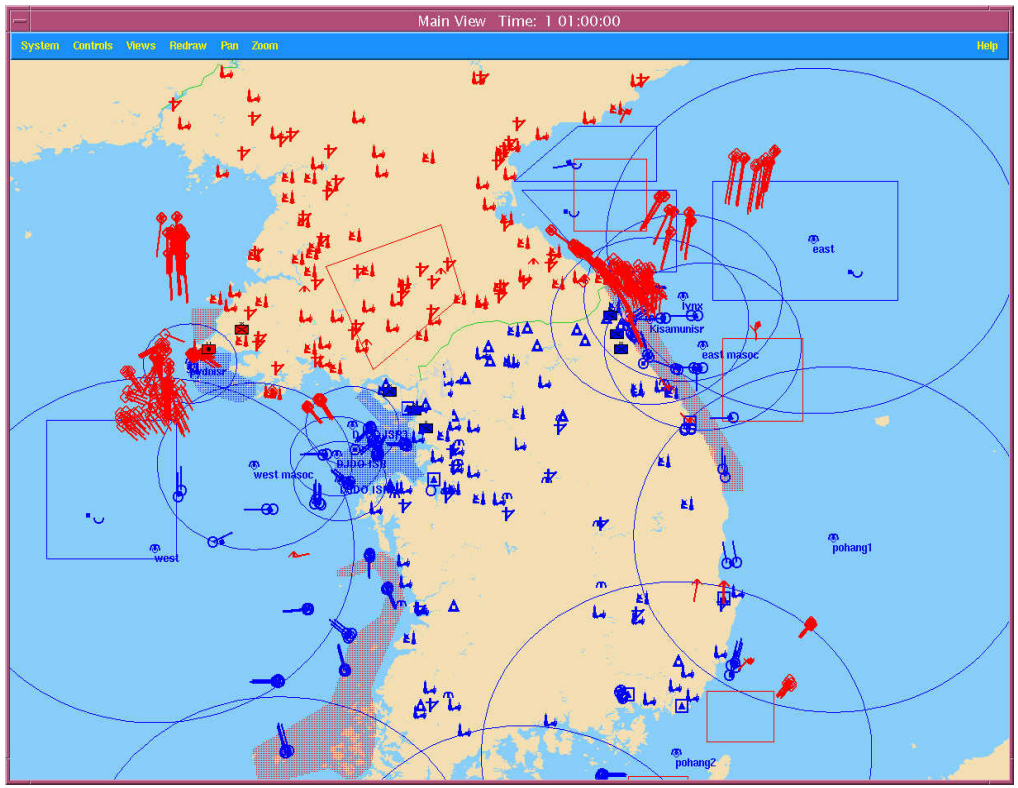
Faster Than Real Time Simulations

Circa 2002-2005

Joint Warfare Simulation (JWARS)

Issues: (1) Prescripted campaign scenarios that run 1000x faster than real time

(2) No human intervention – objects can have free play within the simulation



JWARS Atmospheric Data Set

Spatial Resolution: 1.0 Deg
Temporal Resolution: 6 hr
Vertical Resolution:
- **Six Isobaric (mb) levels**
  - **Levels: 1000, 925, 850, 500, 250, 100**
- **Three Cloud Layers**
  - **“Low”: Base < 2000 m**
  - **“Mid”: 2000 m < Base < 6000 m**
  - **“High”: Base > 6000 m**
- **Surface**

Isobaric Fields

Geopotential Height
Relative Humidity
Temperature
Wind U Component
Wind V Component

Cloud Fields

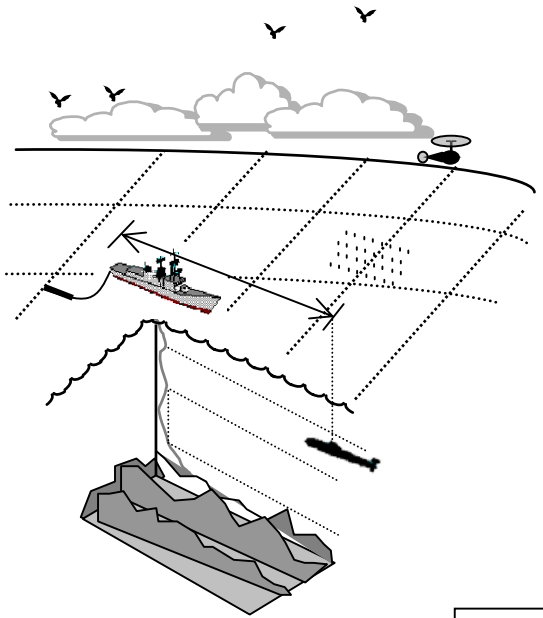
Cloud Amount
Cloud Base
Cloud Top
Cloud Type

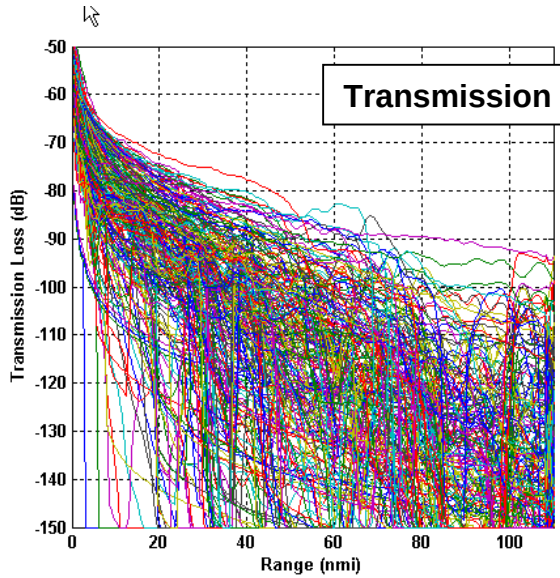
Surface Fields

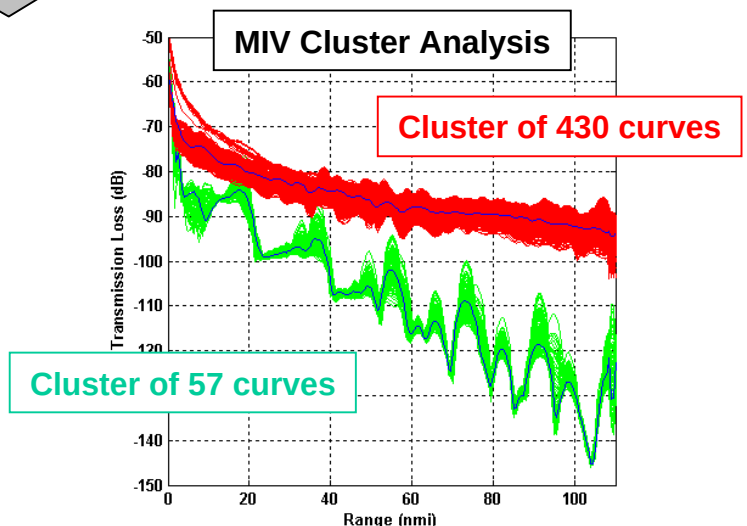
Blowing Sand
Blowing Snow
Cloud Ceiling
Density Altitude
Dewpoint Temperature
Elevation
Evaporation Duct Height
Fog
Icing Intensity
Illumination
Pasquil Stability Index
Precipitation Intensity
Precipitation Type
Pressure Altitude
Pressure Reduced to MSL
Sea State
Snow Depth
Surface Duct Height
Temperature
Thunderstorm Probability
Total Cloud Cover
Total Precipitation
Turbulence Intensity
Visibility
Wind Chill
Wind Gust Speed
Wind U Component
Wind V Component

MODEL-RESPONSE INVESTIGATION AND VISUALIZATION (MIV)

A methodology for using cluster analysis to characterize the way in which an environmental effects model (e.g. acoustic propagation) responds to a particular environment.







Compact TL Library (say, 250 TL curves) representing entire range of TL behaviors

Fleet Battle Experiments

Circa 2002-2004

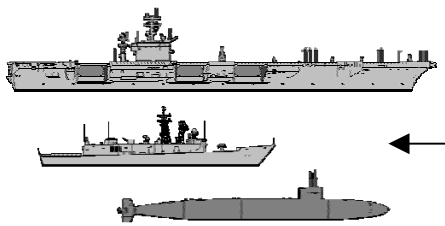
Naval Warfare Development Command, Newport RI

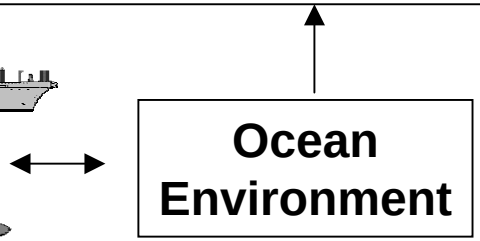
Issues: (1) Live and simulated forces must operate in the same environment

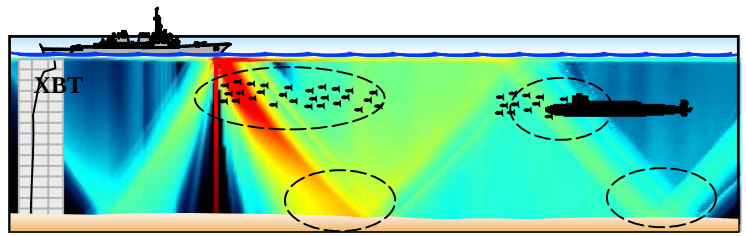
(2) Operational METOC must be foundation for both live and simulated forces

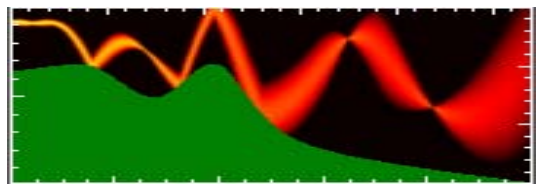
Model Inputs

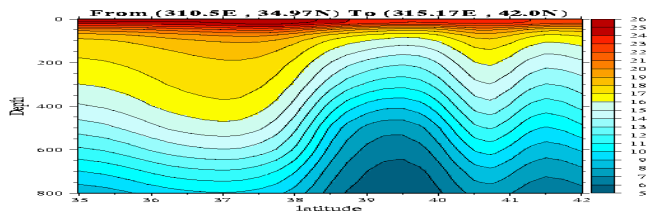
The Navy's Fleet Battle Experiment (FBE) program was designed to explore new weapons systems, technologies, and the necessary concepts, organization, and doctrine to employ them in joint operations.











Joint Semi-Automated Forces (JSAF)
(Sonar Models)

ATLOS Requests

ATLOS Responses

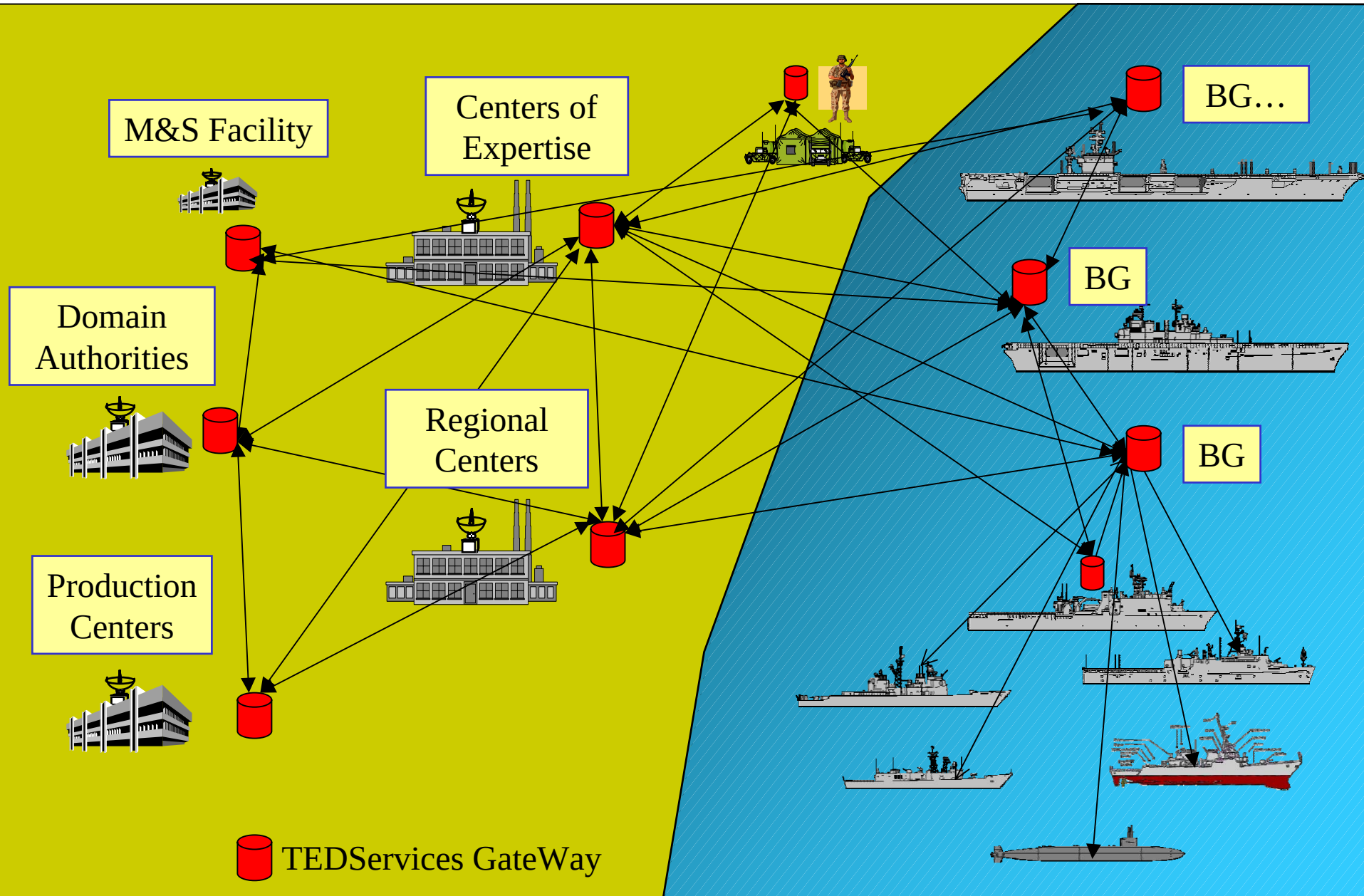
Acoustic TL Server (ATLOS)

Environmental Data Server (OASES)

Ocean Environment

TEDServices

The Operational METOC Data Server



Linking Operations and Simulation

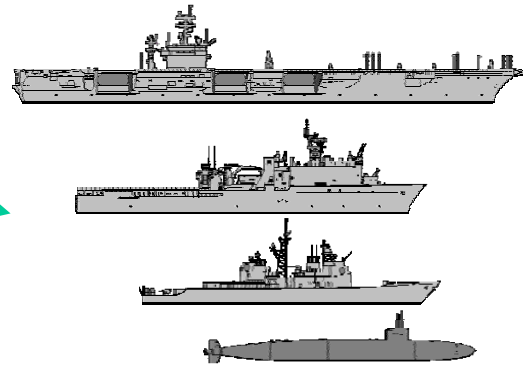
OPERATIONS

Tactical Environmental Data Services (TEDServices)

METOC Data from NAVO, FNMOC, etc

Naval Integrated Tactical Environmental System (NITES)

Tactical Decision Aids Aboard ships at sea



SIMULATION

METOC Data from the ESG

Environmental Data Server (OASES) HLA Compatible

Simulation (Such as JSAF)

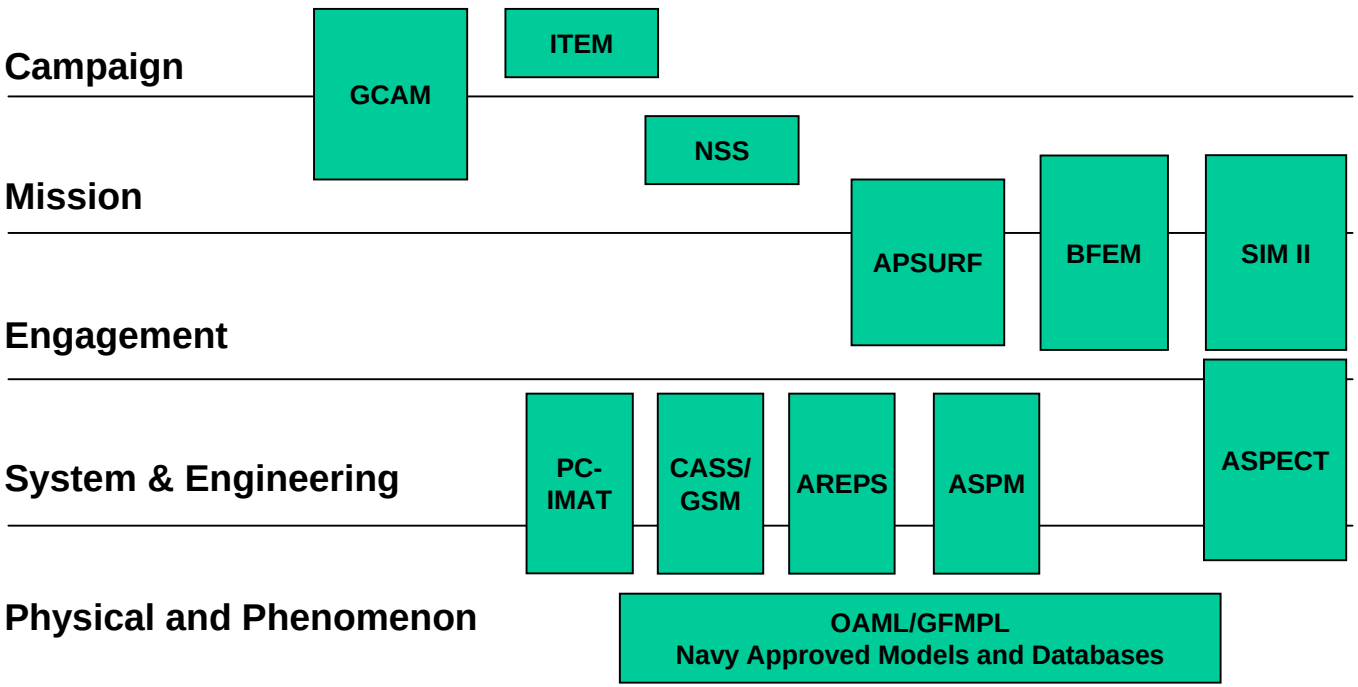
JSAF = Joint Semi-Automated Forces

Theater-level Campaign Analyses Using Legacy Models

Circa 2004-05

OPNAV N81

Issue: Providing representative environments to several disconnected legacy simulations



Approach

Building environmental data that can be

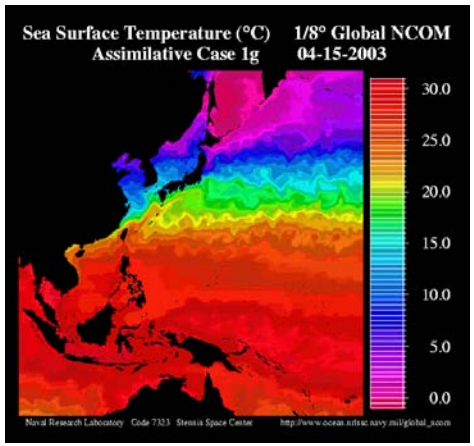
Used in models

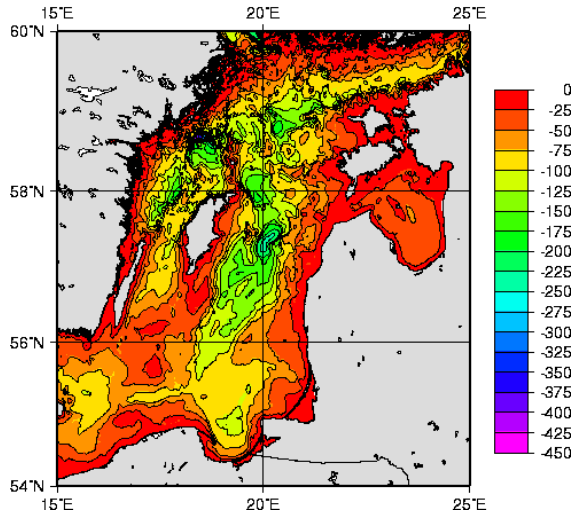
Used in scenario planning

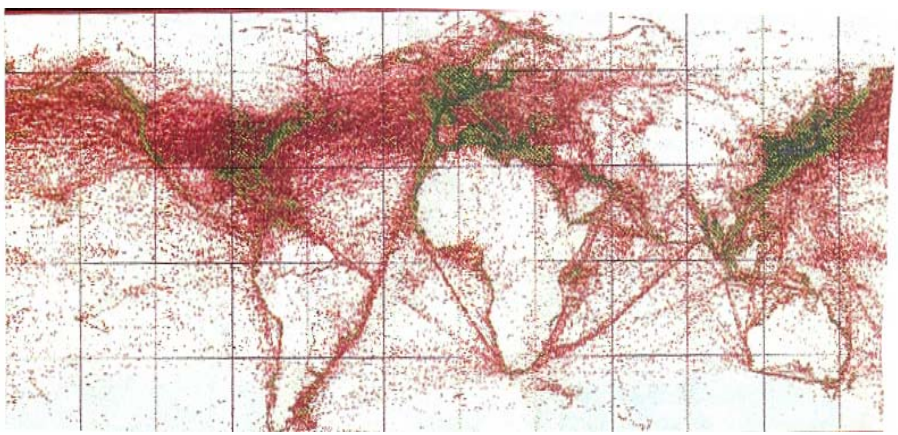
Used for environmental impacts

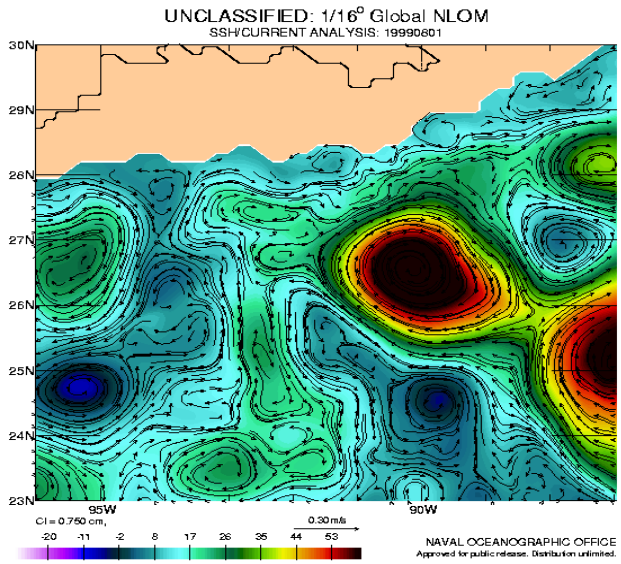
Ocean Models & Databases

Temperature/salinity/sound speed
Acoustic transmission loss
Digital bathymetric databases
Shipping density
Waves
Tides
Currents
Surf
Optics



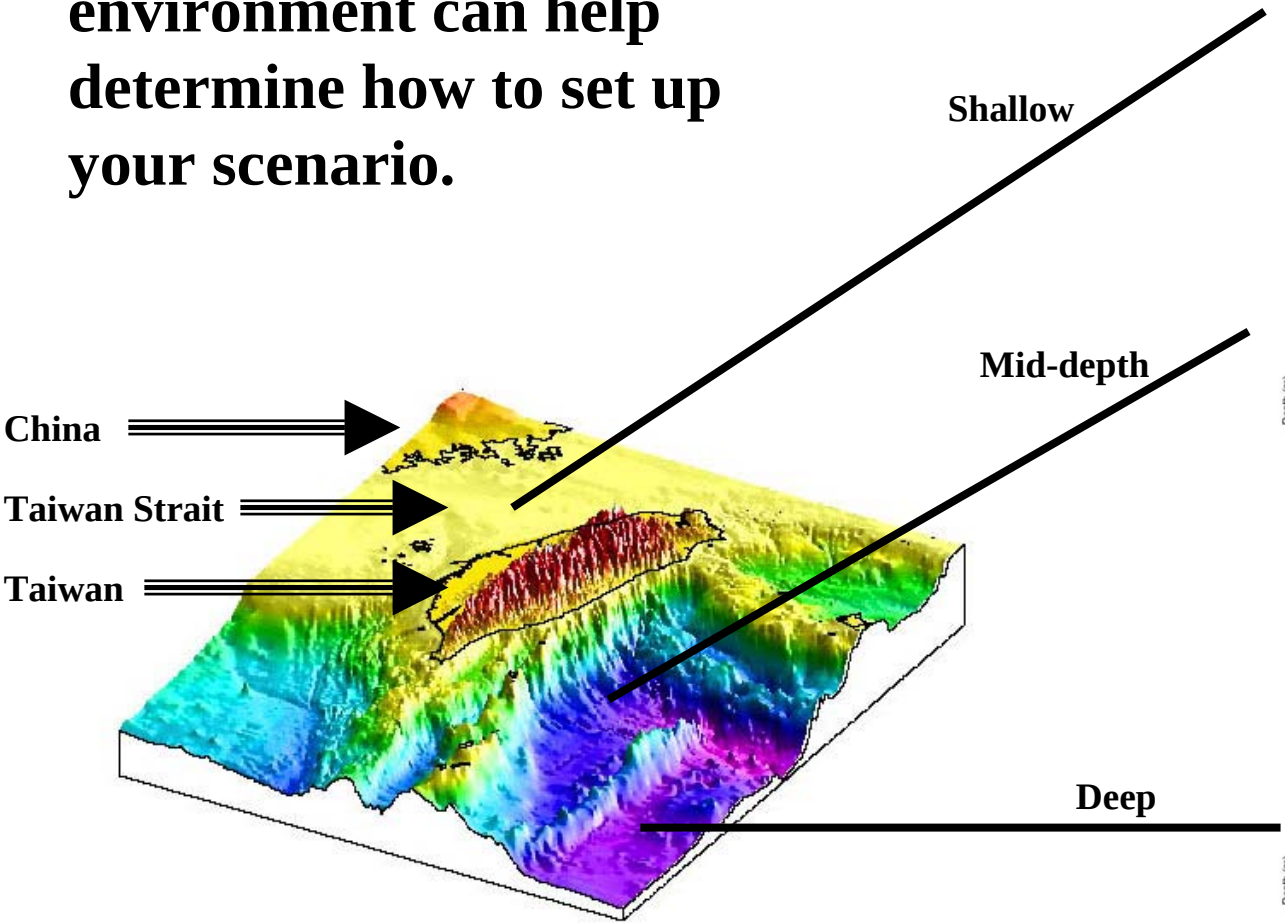


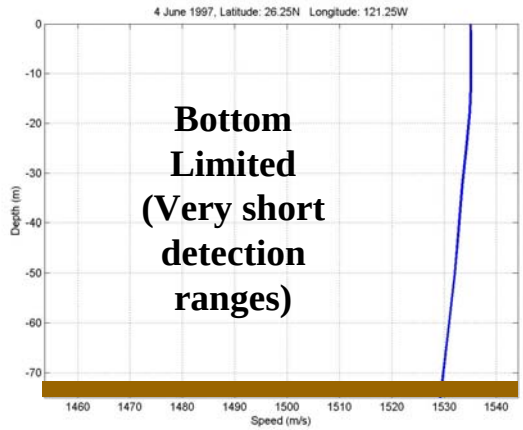


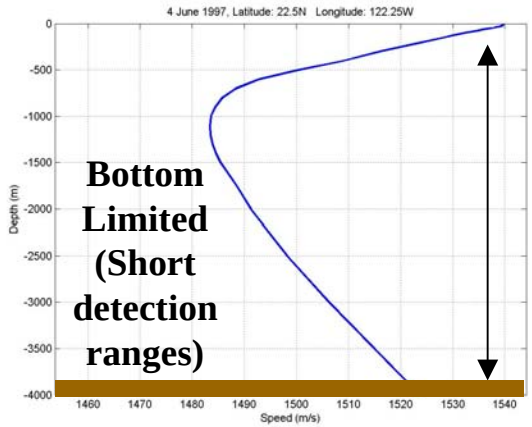


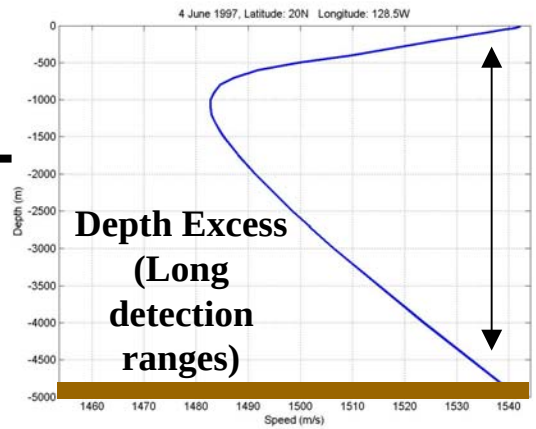
Scenario Planning

Simple plots of the environment can help determine how to set up your scenario.



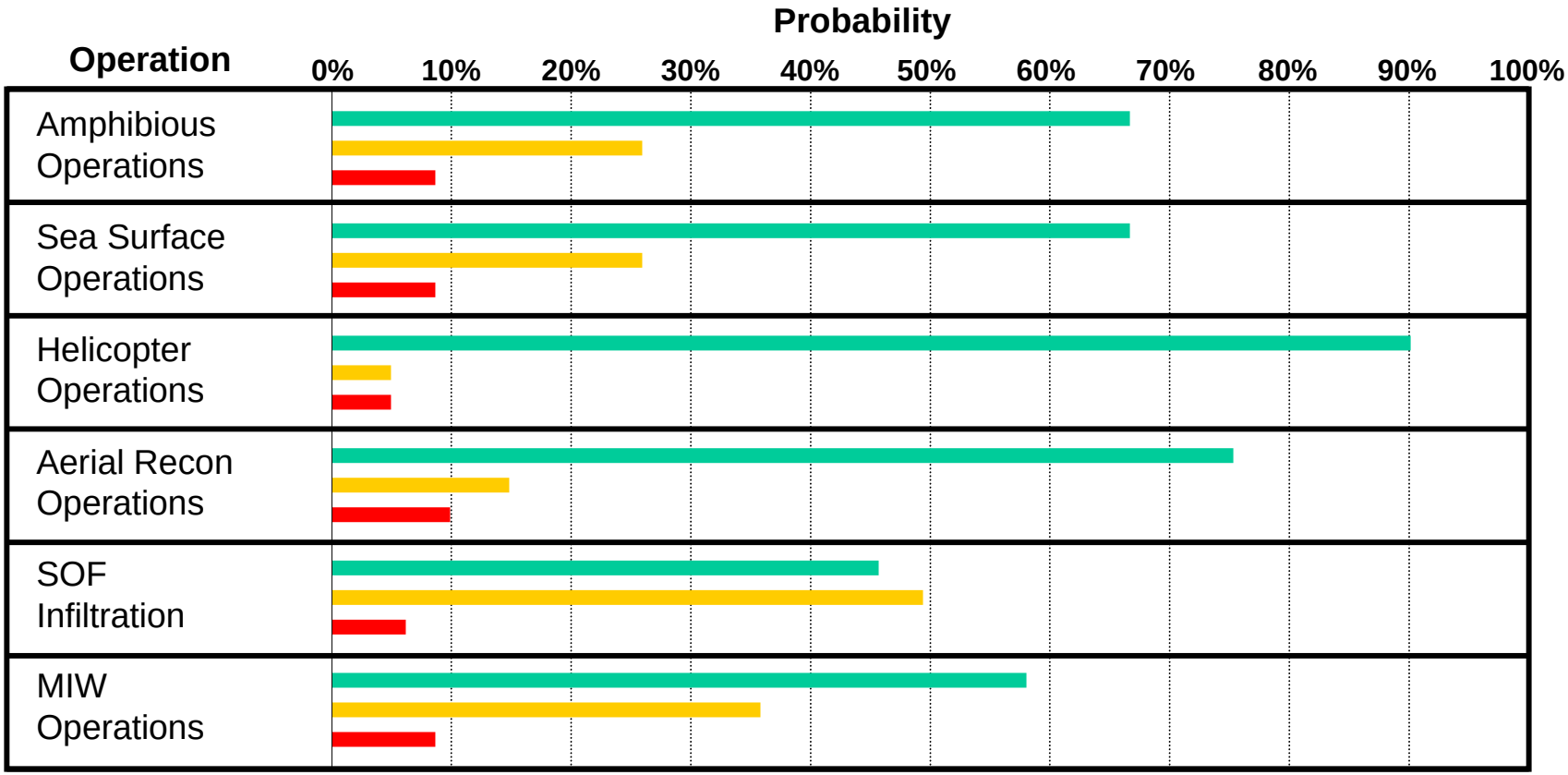






Environmental Impacts

For a Specific Area and Time



No environmental impact
Some impact
Significant impact

Amphibious Ops	Wave Ht >8 ft	>6 ft	<6 ft
Sea Surface Ops	Wave Ht >12 ft	>7 ft	<7 ft
Helicopter Ops	Ceiling <300 ft	<500 ft	>500 ft
Aerial Recon Ops	Visibility <48oo m	<8000 m	>8000 m
SOF Infiltration	Wind Spd >25 kts	>13 kts	<13 kts
MIW Ops	Wave Ht >12 ft	>7 ft	<7 ft

Summary

- **The MSEAs have developed the Integrated Natural Environment Authoritative Representation Process to meet the environmental representation requirements of the DoD M&S community.**

- **The MSEAs have expanded METOC play in**
  - **Global War Games**
  - **JWARS**
  - **Fleet Battle Experiments**
  - **Navy Campaign Analyses**

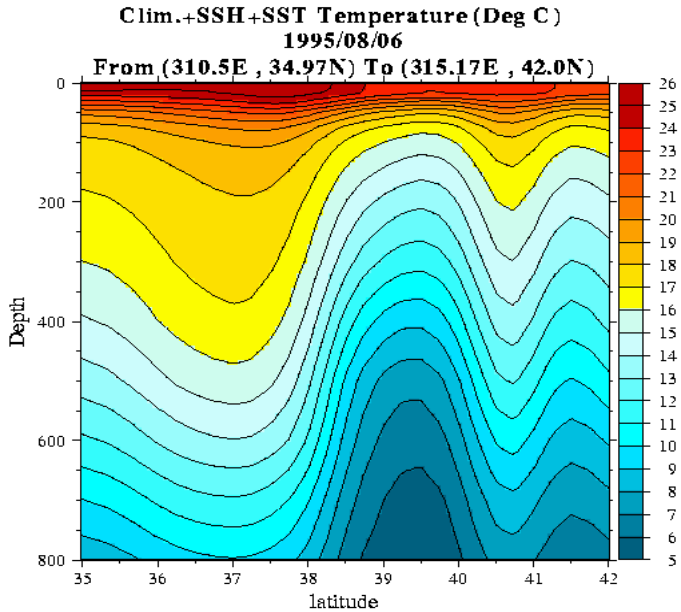
- **But, we are not finished building the capability that's possible, desired and required to support all DoD M&S.**
  - **Technology is there, but resources are scarce.**
  - **Each year the capability grows.**

Coming soon …

10-Year Ocean Volume Archive

Products include:

- 3D volumes of
  - Temperature
  - Salinity
  - Sound speed
  - Currents
- 2D derived quantities of the above at
  - Arbitrary depths
  - Mixed layer depth
  - Sonic layer depth
  - Deep/shallow sound channel axes
  - Depth excess

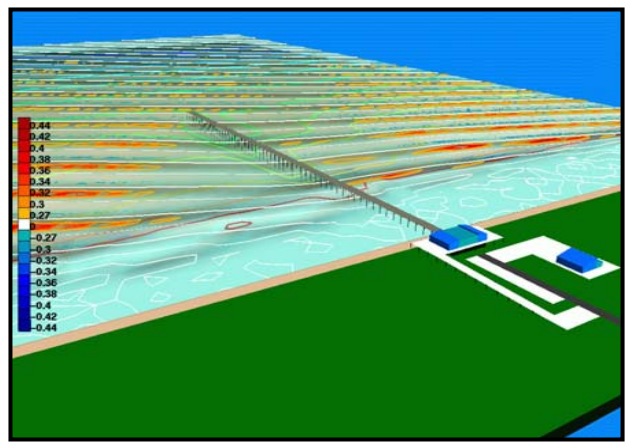


10-Year Ocean Surface Wave Archive

Provides a physically consistent representation of the ocean surface from the open ocean to the surf zone.

Products include:

- Wave Height and direction
- Wave-current interaction
- Significant wave height
- Significant breaker height
- Peak period
- Tides
- Breaker period
- Breaker Type:
  - Spilling, Plunging, Surging
- Breaker angle
- Surf zone width
- Longshore current
- Modified Surf Index



So how do you get access to these capabilities?

Ed Weitzner
Chief of Naval Operations (N7C22A)
METOC Support for Modeling & Simulation

Edward.Weitzner@Navy.Mil

And by the way …
All data is free to DoD and DoD contractors